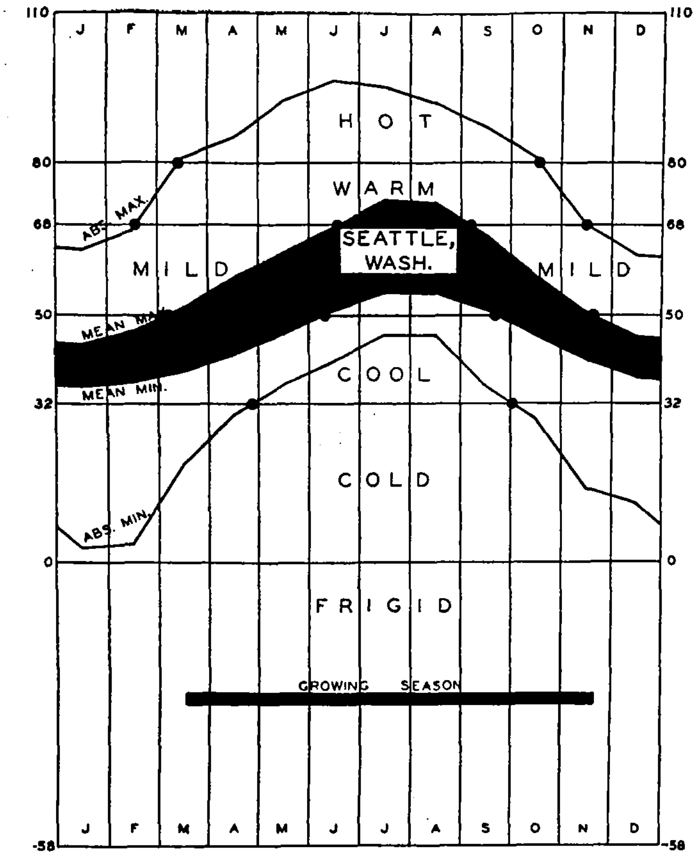


FIGURE 7.—Temperature graph for Seattle, Wash. Note (1) the relatively small seasonal range in temperature for the latitude (marine location); (2) the moderate "normal" diurnal range (humid atmosphere, low altitude); (3) the greater "normal" diurnal range of summer as compared with winter (summer sun control); (5) the long growing season for the latitude.

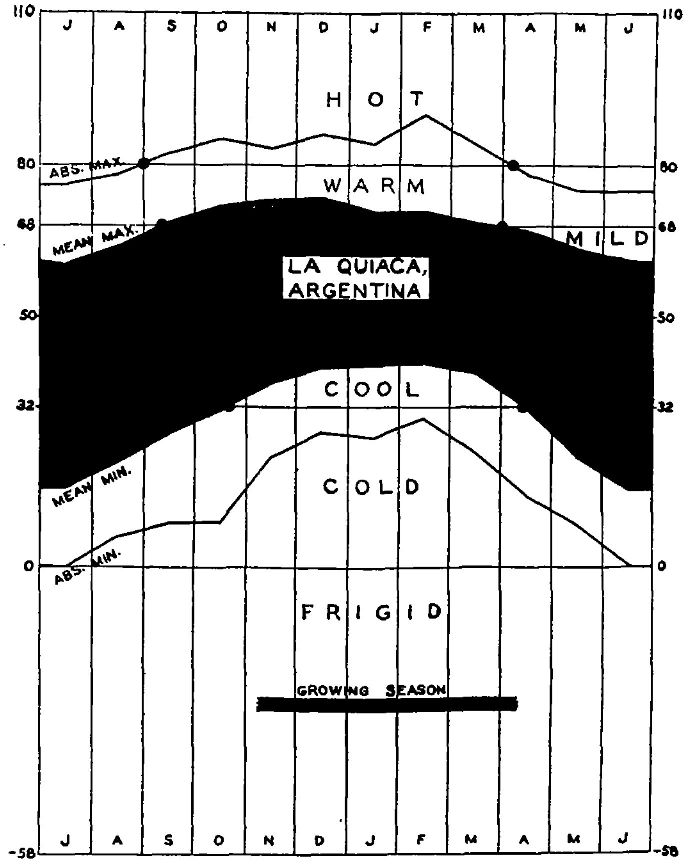


FIGURE 8.—Temperature graph for La Quiaca, Argentina. This station is located in extreme northern Argentina, at an elevation of approximately 11,000 feet. Note (1) the small seasonal range in temperature (low latitude location); (2) the excessive "normal" diurnal range (very high altitude, dry atmosphere); (3) the lack of great temperature extremes (sun control dominant rather than storm control); (4) the short growing season for the latitude.

# SOME PRESSURE-PRECIPITATION TREND RELATIONS

By J. B. Kincer

[Weather Bureau, Washington, D. C., February 1941]

When smoothed curves of weather data covering long periods of time are plotted, the curves show successive wavelike variations depicting alternating fluctuations from wet to dry periods, from relatively cold to abnormally warm, etc.

Before the days of Galileo and Torricelli the vacuum pump was used extensively, but the only explanation of the physics involved was that "Nature abhors a vacuum." Similarly, in an attempt to offer a physical explanation of the complex and intricate processes of Nature that operate to produce these characteristic weather variations, we, today, can do little more than paraphrase the old Florentine gardener's explanation of the vacuum pump: "Nature abhors a straight line."

During recent years much has been learned about trend tendencies in temperature and precipitation—especially the latter. But little attention has been given to the characteristics of long-time barometric pressure tendencies. From our knowledge of the phenomena of air masses and their direct and indirect relations to the occurrence of precipitation, it naturally would be assumed that long-time precipitation trends should have a general relation to sustained pressure anomalies; in other words, that precipitation climatology is directly related to air-mass climatology. We have therefore made extensive summations of pressure anomalies for the past half century, and

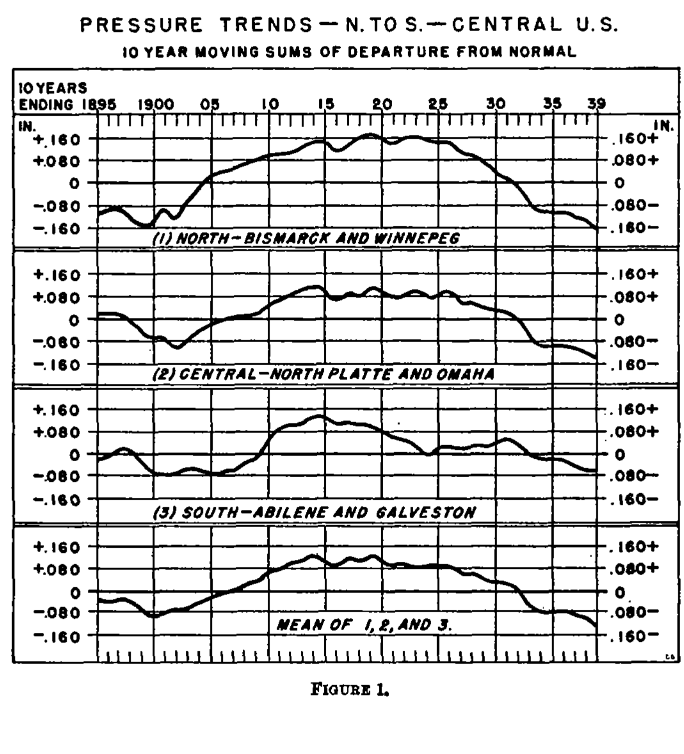


FIGURE 1.

here present some results indicating a close relation to precipitation trends.

In day-to-day weather, precipitation is usually associated with the positions and movements of barometric depressions; it is therefore interesting and rather unexpected that, in this study, long periods of comparatively abundant precipitation were found as a general rule to be associated with above-normal pressure. However, pre-

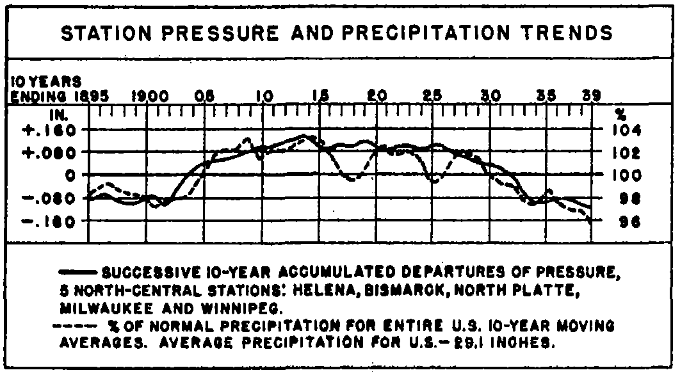


FIGURE 2.

cipitation depends not so much on the actual pressure as on the south-to-north gradient. A wet period in the United States is associated with high pressure over northern areas and relatively low pressure to the south, a dry period with the reverse. (By a wet or a dry "period" is meant a comparatively long interval of time, as distinguished from day-to-day synoptic conditions.)

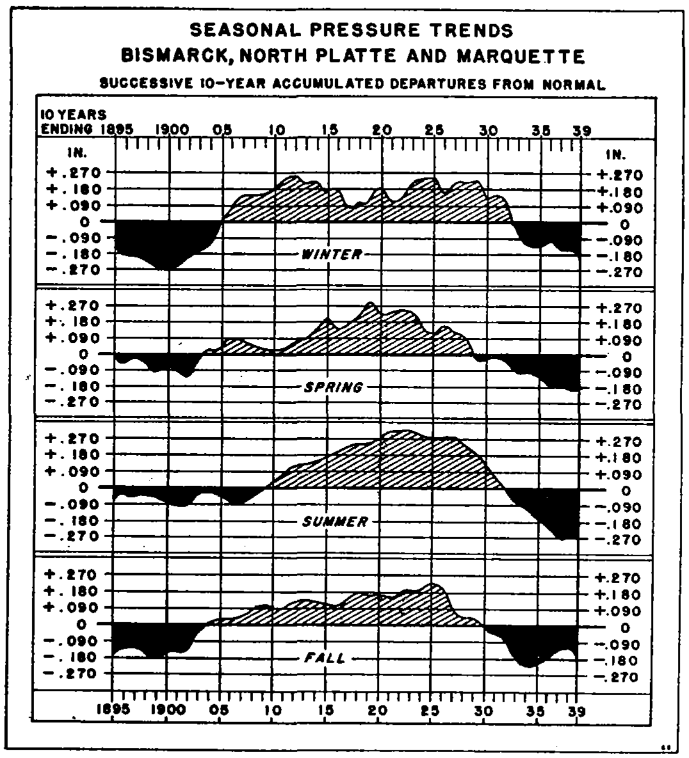


FIGURE 3.

For convenience, a pressure increase from south to north is designated as a plus gradient, and a decrease as minus; that is, when the chart shows the pressure higher in the north than in the south the gradient is considered as positive, and vice versa. The data, in general, represent the accumulated, or algebraic sum of, departures from normal station pressure for the periods specified.

Figure 1 shows the actual pressure trends for a north-south belt through the center of the United States for the period 1886–1939. Incidentally, this region, particularly the northern portion, appears to hold a dominant pressure control over precipitation in the United States, as shown by figure 2. For the country as a whole, the early part of this 54-year period was comparatively dry, the middle decades wet, and the more recent years again dry; and the pressure and precipitation curves on this graph show remarkable agreement.

Figure 3 indicates that these characteristic pressure trends are not determined by a particular season of the

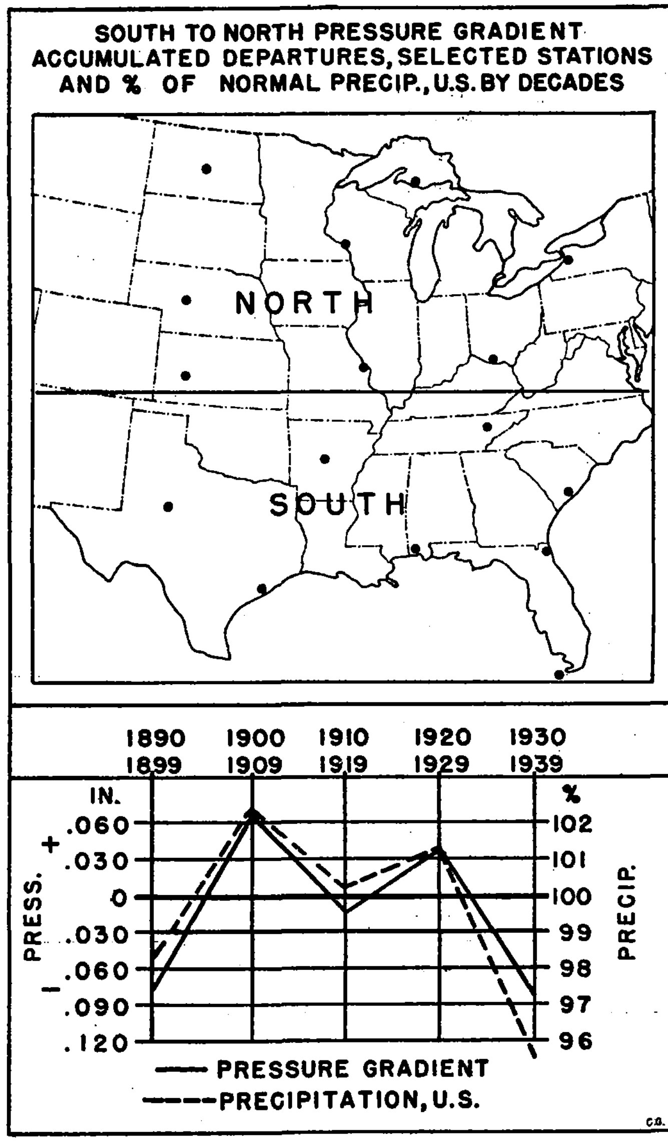


FIGURE 4.

year; all of the seasons show decided conformity, although the general pattern is strongest in summer.

Figure 4 shows the relation of precipitation in the United States to a south-north pressure gradient by decades. For the construction of this chart the average accumulated pressure departures from normal for the 8 stations north of the horizontal line, and for the 8 south of it, were computed for each 10 years from 1890 to 1939; that is, for 5 individual decades. The algebraic differences were considered to be the gradients, plus when the north was greater and minus when the pressure was higher in the south. The dash line shows the average percentage of normal precipitation for the entire United States for the respective 5 decades.

During the 54-year period the wettest decade for the country as a whole was that ending with 1915. Figure 5 shows the pressure-precipitation relation for these 10 years. It will be noted that in general the pressure was

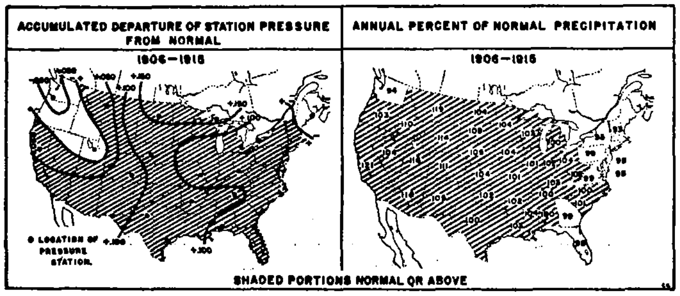


Figure 5.

above normal but with a south-north positive gradient over central areas. It is interesting to note that where this gradient broke down toward the northeast and far northwest precipitation was lighter.

On the other hand there were two markedly dry decades —1886–95 and 1930–39. Figure 6 shows the correspond-

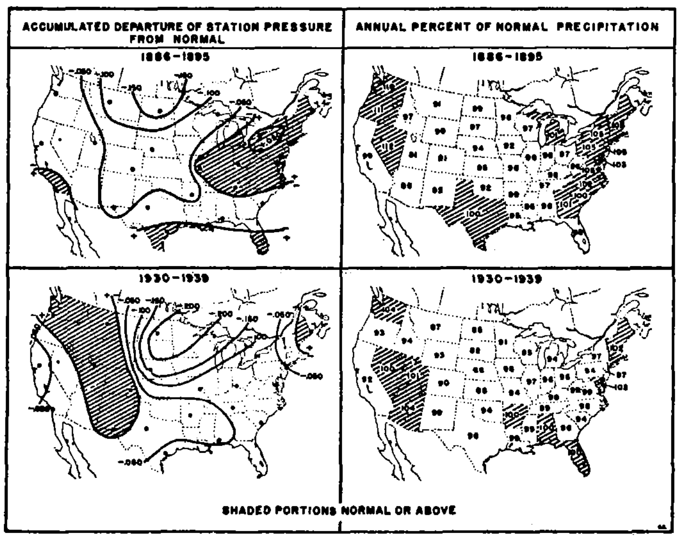


Figure 6.

ing pressure relation. Here, as in the other case, local reverses, such as in the more eastern States in the early decade, are strikingly in evidence.

It was found that the same general relations hold for individual years as well as for longer periods. The two wettest years of record were 1905 and 1915; and figure 7 shows the pressure trend relation for these. In each the high pressure was well north and the low to the south.

Data for the three outstandingly dry years of the last decade—1930, 1934, and 1936—are shown in figure 8. The chart for 1930 shows dry conditions for the more eastern States, conforming to the negative pressure gradient; and comparatively wet weather in the other

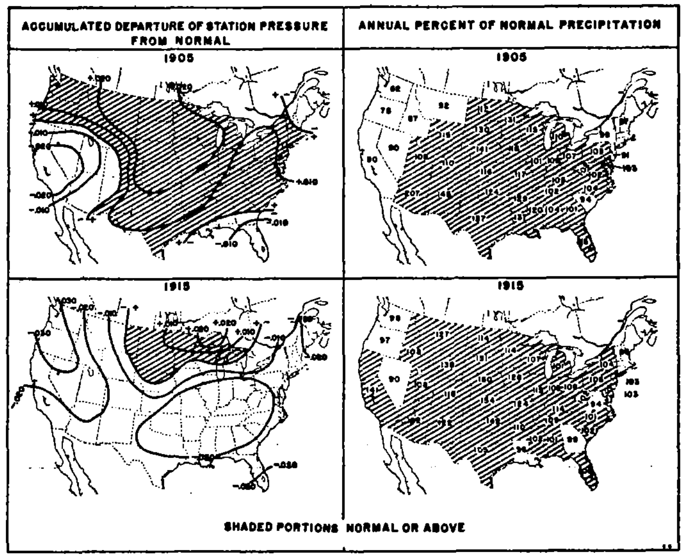


Figure 7.

years where this gradient was reversed, as well as conformity through the interior of the country.

For a still further restricted time, figure 9 shows data for the very wet summer of 1915 and the driest summer of record—1936. Also, on a monthly basis, figure 10 shows the relations for the very dry November of 1939 and the equally wet November of 1940. Here, as in other contrasting maps, the relative south-north positions of the high and low pressures show reversal.

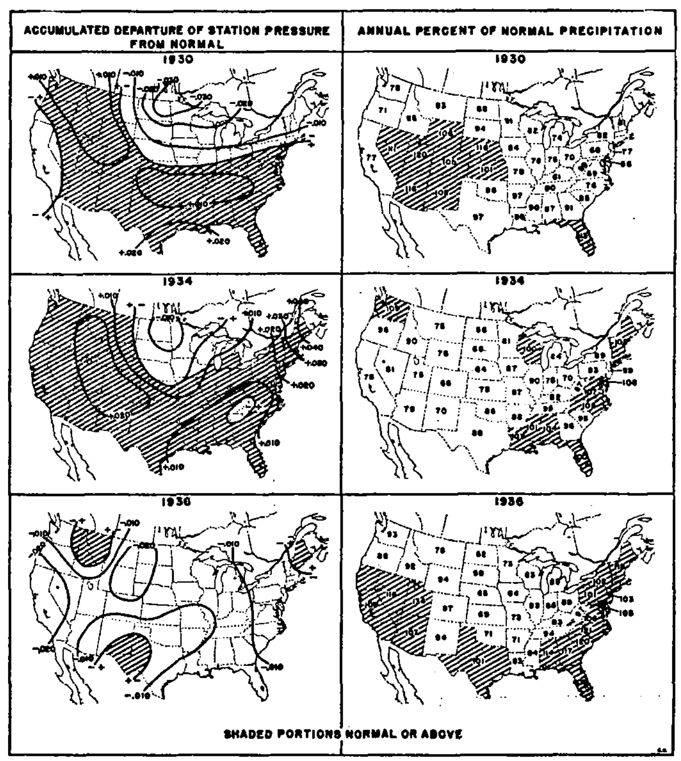


Figure 8.

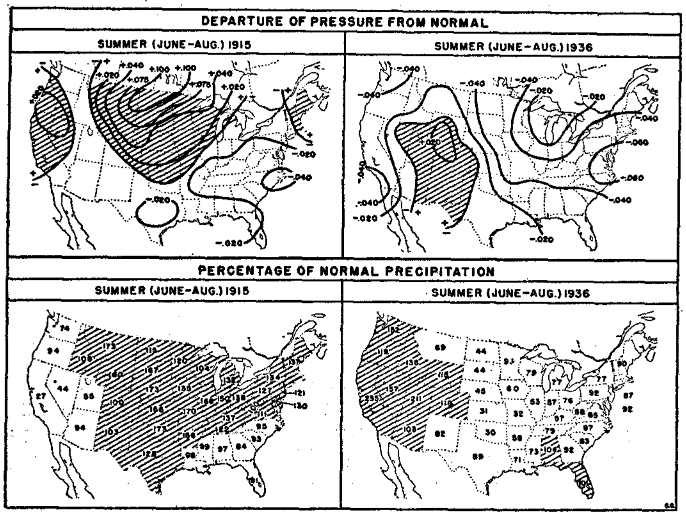


Figure 9.

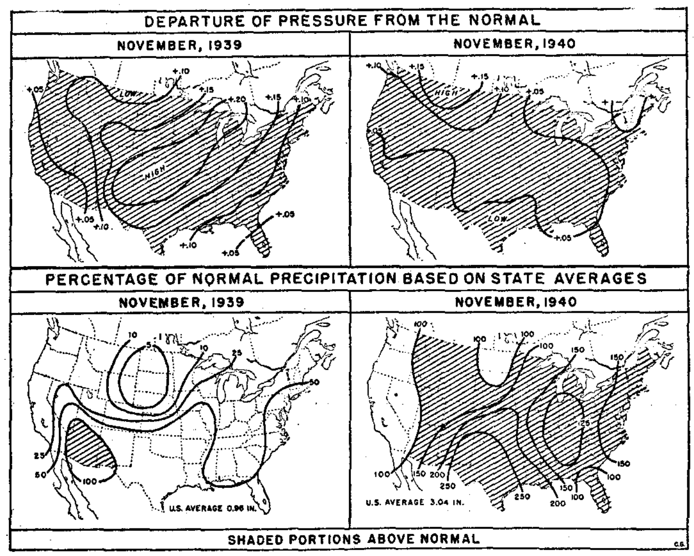


Figure 10.

# METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR AUGUST 1941

[Climate and Crop Weather Division, J. B. Kincer in charge]

## AEROLOGICAL OBSERVATIONS

By Homer D. Dyck

For the country as a whole, mean surface temperatures for August were above normal. The temperature averaged somewhat below normal in the Appalachian Mountain sections, the eastern Lake region, and Northeast and near normal from the Rocky Mountains westward, except that the month was 2° or 3° F. warmer than normal locally in the interior of the Pacific Northwest and along the California coast. From the western Ohio, central Mississippi and lower Missouri valleys northwestward, the monthly means were from 2° to as many as 7° F. above normal.

At 1,500 meters above sea level, the 5 a. m. resultant winds for August were from directions to north of normal over the upper Mississippi valley, the Lake region, the Ohio valley and Tennessee and the north and Middle Atlantic States, and from south of normal at this level over most of the remainder of the country. At 3,000 meters, the morning resultant winds were more northerly over the Great Plains from Oklahoma northward, the upper Mississippi valley, the Lake region, the Ohio valley and the Northeast, and more southerly than normal over the rest of the country. In comparing 5 p. m. resultant winds at the 5,000-meter level with 5 a. m. resultant normal winds, it can be seen that the afternoon winds were from directions to north of the corresponding morning winds at more than half of the stations for which these data were available.

It may be noted that over the northern part of the United States east of the Rocky Mountains and the Middle and North Atlantic States where a turning to northward of resultant wind directions occurred, temperatures below July's were evident; while where a turning to southward occurred east of the Rocky Mountains, temperature values above last month's were noted. On the other hand, the turning to southward west of the Rocky Mountains was accompanied by lower temperatures this month.

At the 1,500-meter level resultant wind velocities were greater than normal over the Lake region, the Gulf region, and several stations in the Pacific Northwest; elsewhere velocities at this level were mostly below normal. At 3,000 meters resultant wind velocities were above normal east of the Mississippi and over the southern Plateau and below normal over the remainder of the country. The 5 p. m. resultant velocities were generally higher than the corresponding 5 a. m. normals at 5,000 meters.

At 1,500 meters the 5 p. m. resultant directions were to the north of the 5 a. m. resultants over the Gulf States and most of the northern Plateau region except Washington, while a turning to southward during the day was noted over the remainder of the country. On the other hand, at 3,000 meters the resultant winds turned to northward generally during the day except over the central Great Plains and the northern Plateau region where they turned southward.

The 5 p. m. resultant velocities at 1,500 meters were lower than the corresponding 5 a. m. resultant velocities at most stations except those in the Pacific Northwest, the eastern Lake region, and the Northeast, where higher p. m. resultant velocities were recorded at this level. At 3,000 meters 5 p. m. resultant velocities were lower over the Plateau region, the northern Great Plains, Georgia, and South Carolina. Elsewhere p. m. velocities were generally higher at this level.

The upper-air data discussed above are based on 5 a. m. (E. S. T.) pilot-balloon observations (charts VIII and IX) as well as observations made at 5 p. m. (table 2 and charts X and XI).

Radiosonde and airplane stations located in the southern part of the country recorded on the average the highest daily pressures at each of the several standard levels from 2,000 meters to 18,000 meters. The highest mean monthly pressure occurred over San Antonio at each of the standard levels between 2,000 and 7,000 meters, while at 8,000 meters both San Antonio and Phoenix recorded the highest. At standard levels from 9,000 to 14,000 meters,